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PRESENTACIÓN

En la presente publicación se recogen los trabajos aceptados como ponencias, en cada una de sus modalidades, para el XIV Congreso Internacional de Interacción Persona-Ordenador (Interacción 2013), que se celebra del 17 al 20 de septiembre de 2013 en Madrid, dentro del marco del IV Congreso Español de Informática (CEDI 2013).

Interacción 2013 es un congreso internacional que tiene como principal objetivo promover y difundir los avances recientes en el área de la Interacción Persona-Ordenador, tanto a nivel académico como empresarial. En este simposio se presentan nuevas metodologías y herramientas para la creación y evaluación de interfaces de usuario, así como novedosos métodos y dispositivos de interacción con usuarios en los ámbitos industriales y experimentales.

La Asociación para la Interacción Persona-Ordenador (AIPO) lleva organizando este congreso desde el año 2000 (Granada), habiéndose celebrado durante sucesivas ediciones en Salamanca (2001), Leganés (2002), Vigo (2003), Lleida (2004), Granada (durante la celebración del CEDI 2005), Puertollano (2006), Zaragoza (durante la celebración del CEDI 2007), Albacete (2008), Barcelona (2009), Valencia (durante la celebración del CEDI 2010), Lisboa (2011), Elche (2012), y ahora, en su decimocuarta edición, en Madrid durante la celebración del CEDI 2013. Las actividades científicas de AIPO cuentan además con el apoyo del Capítulo Español en Interacción Persona-Ordenador de ACM-SIGCHI.

A través de las distintas ediciones, Interacción se ha consolidado como uno de los congresos nacionales más relevantes, siendo actualmente punto de referencia no sólo para la comunidad investigadora en Interacción Persona-Ordenador nacional, sino también para la internacional. A través de los distintos proyectos acometidos, Interacción, junto con AIPO, ha suscitado el interés de investigadores de los distintos campos (informática, telecomunicaciones, biblioteconomía, arte y diseño, psicología, sociología, etc.) que componen un área multidisciplinar como es la Interacción Persona-Ordenador.

En concreto en esta edición, este libro de actas refleja la evolución de la investigación en Interacción Persona-Ordenador, a través de trabajos de cooperación inter-universitarios y aportaciones de empresas del sector. De las 48 contribuciones recibidas se han aceptado a 21 en su categoría de envío, lo que supone una tasa de aceptación de 43,75%. En estas actas, los nuevos enfoques y paradigmas subyacentes son el reflejo de una disciplina cambiante y sujeta a los avances tecnológicos, como se demuestra por el creciente número de artículos que versan sobre educación, nuevos métodos de colaboración, la accesibilidad,

la usabilidad, el diseño centrado en el usuario y la evaluación de sistemas interactivos, por citar algunos campos.

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ÍNDICE DE CONTENIDOS

Interacción, discapacidad, contexto y aspectos Metodológicos

Usabilidad y diseño centrado en el usuario

Colaboración y ubicuidad

Sesión de pósteres

Chats for all: A user survey to improve chats' interaction

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ABSTRACT
The use of chats is being increased; however, they cannot be used by everybody because they present accessibility barriers. Previous research works have solved some of these problems, but accessibility problems related to the user interaction have not been solved yet. This work is part of a research which main goals are to provide a model-based accessible chat and a development process strategy to create accessible chats using it. This research is in the analysis phase and the elicited requirements must be validated. Thus, this study aims to validate one of the requirements proposed to improve the chats' user interaction, the *Stop Auto-refresh* functionality, and to obtain the necessities that users need in a chat. To achieve it, 45 questionnaires and 3 interviews have been carried out by users with diversity of abilities. Finally, it could be underlined that people with visual, motor or learning and cognitive disabilities could found this new feature very interesting and useful.

Categories and Subject Descriptors
H.5.2 [Information Interfaces and Presentation]: User Interfaces – *Evaluation/Methodology, Interaction Styles, User Centered-Design,*

H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces – *Evaluation/Methodology, Synchronous interaction.*

General Terms
Measurement, Experimentation, Human Factors, Verification.

Keywords
Survey; User interviews; Accessibility Questionnaires; Chat; User experience; Accessibility Barriers; Chat Interaction; Special needs; Disability

1. INTRODUCTION
Users have incorporated chats in their daily life to communicate with their colleagues and friends. However, chats have many accessibility problems which make difficult their use by some users. Some of these problems are related to the flow and rhythm of the conversation [17] or the use of updated content which is unproperly tagged [14]. Previous chats have tried to improve these accessibility problems. However, these solutions do not involve users during its life-cycle development, they do not follow accessibility standards and guidelines, they are developed for a specific platform, etc. [5]

This work is part of a research which aims to provide a model-based chat and a development process strategy to create accessible chats using it. This work is currently into the analysis phase; thus, the requirements have been elicited and formalized and they must be validated. Some of the elicited requirements aim to improve the user interaction in chats like allowing users to configure the auto-refreshing time or allowing users to specify the chat messages' order. In this paper, one of these functionalities is studied in depth, the *Stop Auto-Refresh* functionality. This new functionality allows users to stop the reception of messages and informs other users that this person needs more time to write. The survey study presented in this paper aims to know the users' opinion about this new functionality and moreover, to obtain the main problems that users usually face when they use chats in desktop and Mobile Devices (MDs).

This paper is divided into five main parts. The section 2 explains previous background of the study. Secondly, the section 3 specifies how the questionnaires and the interviews were carried out. Later, the section 4 explains the results obtained and an analysis of the results is specified in the section 5. Finally, the obtained conclusions are detailed. Next, these phases are explained in depth.

2. BACKGROUND
This section specifies the laws, guidelines and standards with regard to accessibility; the chat accessibility barriers; previous accessible chat approximations; previous surveys which are centered in obtain patterns of use of chats; the accessibility problems that chat users face and the motivation of this study.

2.1 Accessibility: Directives, Legislation and Standards
People with disabilities should have the opportunity to access to the Information Computer Technology (ICT) without any handicap. However, some people's rights are violated because ICTs are not created in an accessible way and people can feel discriminated [25]. There are different accessibility standards, guidelines and laws which normalize or regulate the access to ICTs for everybody.

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Congreso promovido por AIPO – Asociación para la Interacción Persona-Ordenador.

From the legislative point of view, some countries have created laws to protect people's rights when they use ICT s. For instance, USA created the Section 508 of the US Rehabilitation Act [21]. Besides, Spain created the Ley de Servicios de la Sociedad de Información (LSSICE)[4] and Europe provided the *2005 Communication on eAccessibility* [23]

With regard to the standards and guidelines in desktop computers, the World Wide Web Consortium (W3C) provided the guidelines called Web Content Accessibility Guidelines (*WCAG) 2.0 [27]* to create accessible websites. Besides, some standards are based on the WCAG 2.0 guidelines such as: the Spanish standard UNE 139803:2012 *Web content accessibility requirements [2]* or the ISO organization has developed the standard *ISO/IEC 40500:2012 Information technology -- W3C Web Content Accessibility Guidelines (WCAG) 2.0*[11]. Moreover, AENOR has developed other standards related to ICT s accessibility like the *UNE 139802:2009. Guidance on software accessibility* [1] which specifies how software should be developed to be accessible for people with disabilities and old people and ISO specified the *ISO 9241-20 Accessibility guidelines for information/communication technology (ICT) equipment and services* [10] which provides guidelines to improve the accessibility of ICT equipment and services. Furthermore, there are guidelines related to MDs like the W3C guidelines *Mobile Web Accessibility Best Practices (MWABP)* [28] or the *IMS AccessForAll* which specifies how to create accessible synchronous tools [9].

2.2 Chat Accessibility Barriers

Previous research works pointed out that chat applications present accessibility barriers and they have even additional problems than other ICT systems[8]. These problems can be classified into: accessibility-supported technology, flow and rhythm of the conversation, technology used in the creation and specific problems for MDs [5]. The Figure 1 shows a summary of the main accessibility problems and its classification.

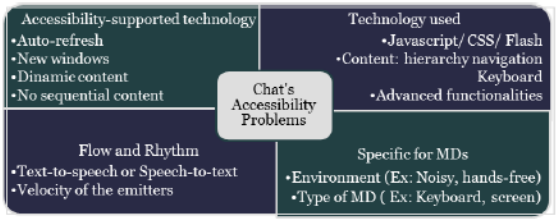

Figure 1. Chat's Accessibility Problems

2.3 Previous Initiatives of Accessible Chats

Some chat approximations have solved certain specific accessibility problems of chats found in previous research works. For instance, Reef Chat [24] uses Rich Internet Application (RIA), AJAX live regions and follows WAI-ARIA [29] and WCAG 2.0 to solve the problem of auto-refresh [17] and follows the WCAG guidelines. Furthermore, the chat of the Atutor[1] Learning Content Management System (LCMS) provides features to configure the time of auto-refresh, allow sorting messages and choose showing new messages exclusively. Besides, *AssistiveChat*[2] provides features for people with speech disabilities such as: suggestion words, predefined sentences or conversion of text-to-speech.

However, until the authors' knowledge there is not any chat which has been created following a User Centered Design (UCD) in their design. This is really important in the user interface and software design because users can express their opinion and experience in the whole design process. As a result, the user experience is affected because it is really necessary to create usable and accessible software. Consequently, accessibility requirements are not taken into account in the chats' user interaction.

Besides, they are designed for a specific platform and technology and their design cannot be extrapolated to other environments. Thus, they are not designed taking into account methodological model-based approaches which separate design from technology. Additionally, they do not solve the accessibility problems that MDs applications have. Finally, some of them do not follow accessibility standards and guidelines to create accessible software.

2.4 Surveys: Chats' Use and Accessibility

Previous studies have carried out surveys to obtain the user preferences and problems related to chats. Some of these studies focused on the use of chats. For example, the survey carried out by Asian Institute of Journalism and Communication [3], shows that most students consider chat less formal than mailing and that more than 50% of students use chats every day or two to three times a week to chat with known people. Besides, there are differences with the use of chats between women and men because women prefer chatting more than men [22]. Furthermore, students prefer the use of Instant Messages (IM) instead of email because most of their friends use them [30]. The study [31] specifies that students prefer the use of IM with their colleagues and email with their teachers because they use the first one in informal conversations and the second one in formal conversations. Considering the use of chats by people in general, the study concludes the user's acceptance is affected by usefulness, ease of use, enjoyment and concentration of the chat [16].

On the other hand, focusing on accessibility, the survey [7] compares the communication between people with learning disabilities and people without learning disabilities through IM, e-Mail and SMS and concludes that IM communication is more effective. This study also indicates that chats present many accessibility problems which are a handicap for some users. For instance, people with dyslexia have problems when they interact with the chat because if they are writing a long sentence, other users can write more sentences and they could feel out of the conversation; thus, they need more time to re-read the sentences and understand them[32]; Besides, as visual impaired users have problems like following the flow and rhythm of the conversation in synchronous tools, they prefer the use of asynchronous tools like email[13].

2.5 Discussion

The creation of accessible software is really important to avoid the barriers that many people experience. Previous surveys and other researches have detected accessibility problems that people face when they interact and one of the most important problems is related to follow the flow and rhythm of the conversation. Moreover, previous chat approaches aim to delete these accessibility problems. However, they have limitations such as:

[1] http://atutor.ca/achat/

[2] http://www.assistiveapps.com

the inclusion of users in the software development, the lack of standards and guidelines in their development, the design for specific technologies or the lack of improvement in the user interaction.

Considering all these aspects, the main goal of the research is the creation of a model-based accessible chat and the development process strategy to create it[5].

This research proposal specifies some of the requirements that an accessible chat should have. One of these requirements is the *Stop auto-refresh* functionality. This feature allows users to stop the reception of messages and inform other users that this person needs more time to write. However, this feature is a theoretical feature and users should specify their opinion with regard to it in order to follow a UCD process.

As the research in which this study is framed intends to follow a UCD and includes users in the whole life-cycle, the main goal of the study presented in this paper is to know the users' opinion related to the *Stop auto-refresh* functionality and obtain the main problems that users usually have when they use chats in MDs and in desktop computers. To achieve it, two survey methods (questionnaires and interviews) have been conducted to obtain the users' opinion. Next sections specify how these survey techniques have been carried as well as the results obtained.

3. Survey Methodology and Design

The survey study presented in this paper aims to collect the accessibility problems that users face when they interact with chats, the users' habits, and their suggestions. Besides, it tries to collect their opinion regarding to the new "*Stop Auto-refresh*" functionality of the chat which will allow users to stop showing new chat messages and inform other users that this person needs more time to answer. Thus, the main objectives of this study are to obtain:

1) Accessibility problems of chats from the point of view of user's experience with other chats as well as suggestions and the absence of some functionalities that could be useful for them.
2) Users' opinion with regard to the hypothetical chat which would have this new functionality *Stop Auto-refresh*.

To achieve it, two survey methods have been combined: user interviews and questionnaires. Both methods have been carried out considering the guidelines related to survey researches [20][12] which explain how to carry out them properly.

The target users were Spanish speakers who have disabilities because the study intends to obtain the barriers that people with disabilities face.

Next sections explain how the survey methods have been carried out in detail.

3.1 User Interviews

Qualitative research is really useful to obtain users opinion in a deep level because answers are opened answers and users can explain their answers [18]. Moreover, these interviews were carried out to validate the questions of the questionnaires created with a small group of people before sending to the users.

3.1.1 Interviews Design

Before each interview, the interviewer explains the interviewee the main goal of the experiment and an introduction about him. Furthermore, some relaxed questions have been asked previously to warm-up the interview. The interviews carried out in this research are semi-structured interviews which follow the questions of the questionnaires distributed to users, see Section 3.2.1 to know the format of the questions, but respondents were able to specify why they have chosen each option. Besides, the interviewer asks questions related to the interviewee's previous answers and his behavior with each question. Thus, the interviewer can make the most of the interview.

3.1.2 Data Collection

The interviews were carried out through a telephone call or audio-conference to people who was interested in becoming part of the research work. The interviewer asked some questions during one-two hours related to their personal situation, the technology use habits and the problems that they face when they use chats. All questions were opened questions and users could explain their experience when they use the chat in different environments such as: desktop or MDs environments, formal or informal conversations or learning environments. After that, the interviewer specifies to the user a specific situation in which the user is using the chat as a synchronous tool and he is receiving many messages in a short period of time. The interviewer asks him how he will solve this situation, his opinion with regard to the new functionality, the auto-refresh functionality, that we propose and if he would feel ashamed with this new functionality. Finally, the interviewer asked users if they have any suggestion to improve the chat interaction. Next, the Section 4.1 presents the main results of the user interviews.

3.2 Questionnaires

The use of questionnaires in software engineering developments, which follow a UCD approach, is useful to ask users opinion with regard to their necessities and experience[26]. Thus, this research work uses questionnaires to obtain it.

3.2.1 Questionnaires Design

This research is an experiment with a theoretical design and is a *Concurrent control studies in which participants are not randomly assigned to groups*. Furthermore, the questionnaire has been elaborated considering the guidelines provided by Kitchenham and Pfleeger[19].

The questionnaires were unsupervised surveys; thus, respondents fill the questionnaire by their own and there is not any person who supervised the questionnaire.

A unique questionnaire has been created in three different formats to ensure that everybody could access to it: plain text (.txt), accessible Microsoft Word (.doc) and accessible online form. Thus, each user could decide which format adapted better to his necessities for filling it.

The questionnaire is composed of a total of sixteen questions. Fourteen of them were rating scale and two of them were open-ended questions. In addition, it is important to emphasize that six of the rating scale questions were also open-ended questions where people can specify additional characteristics which are not in the options. The questionnaire is divided into different parts: personal information (Ex: age, gender, disability), their kind of MD and assistive technology, frequency of use of chats and types

of chats, accessibility problems that they faced, questions related to our new feature and suggestions to include in the chat.

3.2.2 Data Collection

This research follows a non-probabilistic sampling method where people with disabilities were invited to participate in the survey. Specifically, it is followed a convenience sampling method because the users, who participate in the surveys, were willing to take part in the survey.

The questionnaire has been spread through different media such as: social networks, blogs, group mailing lists and so on. The data collection process was open for more than one month and users spent around fifteen minutes to complete each questionnaire.

With regard to the response rate, it is not possible to calculate it due to the questionnaires were spread of through the Internet and the respondents were random respondents.

3.2.3 Data Analysis

After collecting the questionnaires, the data is analyzed to check if the data is robust or not. Thus, it is checked if the questionnaires were whole-completed and fulfilled properly. And finally, wrong questionnaires were not taken into account for the survey.

4. Results

This section explains the main results obtained from the user interviews and questionnaires methods.

4.1 User Interviews

A total of three users have participated in the user interviews. These interviews were carried out by three blind people because as it has been explained before, previous studies have found that people with visual impairments have more problems when they use chats. Thus, blind people have been chosen to participate in the interviews because they will provide really useful information.

4.1.1 Participants Characteristics

The first user is a 55-65 years-old user and he is blind. He surfs on the Internet every day to search for music and books. However, he does not surf on his MD because his MD browser is not accessible; he uses Android 2.2 in his Samsung TGB 7510 MD and none of the available browsers for this operating system is accessible. Furthermore, he uses rarely chats in MDs or desktop computers and the chats that he uses are *Whatsapp*[3] and *Messenger*[4] chats.

On the other hand, the second user is really different to the first one. He is a 35-44 years-old user and he is also blind. He uses his MD (4S Iphone) every day to surf on the Internet because his browser is an accessible browser. Besides, he uses chats like: *Whatsapp, Line*[5]*, Messenger, Skype*[6]*, Spotbros*[7] *and Chats of some Social Networks* to communicate with his friends and colleagues.

Finally, the last user is between 35-44 years-old. He is blind too and his MD is a Nokia 6710. He uses chats in desktop computers but not in MDs. He uses Internet to surf on it, to study and to create blogs. Moreover, he is used to use chats to communicate with his friends and with other students. With regard to the chats that he uses, he specifies he uses *Messenger* and chats of some LCMS because he studied an online Master.

4.1.2 Analysis of Interviews' Results

4.1.2.1 Usual Accessibility Problems

The first user considers when he uses chats he is losing his time because he spent a lot of time on writing messages. He explained that:

"Chats are not useful for me. I am wasting my time when I chat".

Moreover, if he is in a conversation, he is not able to write as quickly as the other person and he becomes stressed because he receives a lot of messages at the same time.

With regard to the second user, he considers that chats are really useful for him and uses them every day. When he uses chats, he experiences some difficulties and these barriers can be more or less serious, if he uses one or other chat. He said:

"Line has some images-buttons without alternative text and I cannot know the purpose of the button. Moreover, when I receive a new message notification in Whatsapp, it opens the last conversation that he has opened and it does not open the last message received. It is a problem because the screen reader does not notify it and I know that once I wrote to another person. Thus, I press the top of the screen always to auto-refresh the screen"

Besides, he considers that the use of the chat of *Facebook* is easier in MDs than in desktop computers because the navigation is easier. And he considers that *Spotbros* is completely inaccessible for him because it is not prepared to be used by screen readers.

The third user considers that communicate through chat is useful for him. However, he experiences some difficulties when people use emoticons to specify something in the sentences.

"*When I am speaking with someone and he says „I go to + EMOTICON", I cannot understand the meaning of the whole sentence"*

Another difficulty is related to response sentences. If he is speaking with many people, he sometimes cannot follow the conversation because he answers previous messages.

"If I am writing previous messages, the other people write messages and my messages become obsoletes"

In addition, it is important to emphasize that this person has used the chat in LCMS and the chat does not updated continually. Thus, if he wanted to know the last sentences he had to refresh the page manually and sometimes he was not able to know the conversation.

4.1.2.2 The "Stop Auto-refresh" Functionality

The first user considers that this new functionality would be really useful for him because he would stop the reception of new messages when he feels overwhelmed and he would not be ashamed if he used it. However, he prefers that the other user does not write anything else as he could feel overwhelmed again. He explained:

"If I have stopped the reception of messages,I would like the other person stop writing messages. If the other person were

[3] http://www.whatsapp.com/

[4] http://windowslive.es.msn.com/messenger/

[5] http://line.naver.jp/en/

[6] http://www.skype.com/es/

[7] http://www.spotbros.com/

writing many messages in this period of time and I will receive all of them at the same time, I will feel that the other person is bombing me with new messages and I will feel overwhelmed again"

Besides, the third user specifies that it can be useful especially in environments where many people interact. Furthermore, he prefers the reception of the messages later to know what has been explained after the stop of reception messages and he considers that it must be informed other users about the stop of messages reception.

"If I am not able to write quickly or to follow the conversation is not a problem, it only means that I need more time"

On the other hand, the second user specifies that he does not feel overwhelmed when he uses the chat because he is used to use chats in MDs and in desktop computers. However, he considers that the use of this feature could be useful but depending on the number of users.

If there were more than two users, the flow and rhythm of the conversation could be affected when he access to the new functionality and consequently, the other people could not write more messages. Thus, he suggested:

"The other people could write more messages because I do not want to interrupt the conversation. Later, I could receive all messages together. Moreover, it will be important to specify in which moment these messages were sent. If it would not be specified, there could be a loss of context and I could not follow the conversation"

On the other hand, if there were two users (he and other user), he could access to the button *Stop Auto-refresh* and the other user can wait until he renews the conversation. In this case, he considers that the flow and rhythm could not be affected. With regard to his feelings, if we used this feature, he explained that he would not feel ashamed because all his friends know his disability.

As a result, people with less experience in the use of chats considered that this new feature could be useful for them because they could stop the reception of messages. However, the more experienced person considered that it could not be useful for him. Furthermore, none of them would feel ashamed if they accessed the button and inform other users about this circumstance.

4.1.2.3 User Suggestions

The first user did not specify any additional features for the chat. However, the second user specifies that it was really important that a chat should be compatible with assistive technologies such as: screen readers or speech-to-text. Besides, the third user specifies that the storing of the chats is really important for him because if he had felt lost during a conversation, he can re-read the conversation again.

4.2 Questionnaires

A total of 53 users have participated in the sent questionnaires. But, the number of selected questionnaires was 45 because some of them were not completed properly or they are not part of the target population because they do not have any disability. Next, the characteristics of these users and the results obtained are explained.

4.2.1 Participants"Characteristics

The questionnaires where completed by 24 males and 21 females. All of them have a disability such as: visual, hearing, motor or learning and psychological disabilities which are included in the category of other. However, four people have more than one disability. Next, Figure 2 shows a relation between the age of users and the disabilities.

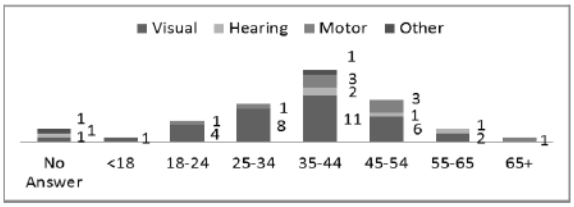

Figure 2. User's Age and Disability Characteristics

With regard to their experience in the use of chats in MDs and desktop computers, 53,33% of users use chats every day in their desktop computers and 48,89% of users in MDs. In contrast, 2,22% of users do not used to use chats in desktop and 20% in MDs. The Figure 3 shows the percentage of use of chats in desktop and MDs by respondents.

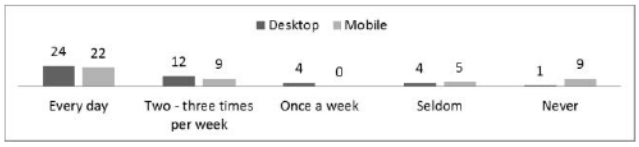

Figure 3. Chat use in Desktop and MDs

Moreover, users should specify which is the chat/chats that they are used to use. Figure 4. Shows that the most used chats are those chats of social networks like Facebook and Whatsapp chat.

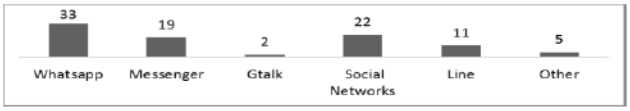

Figure 4. Most Used Chats

4.2.2 Analysis of Questionaires"Results

This section analysis the results obtained in the questionnaires filled by the users.

4.2.2.1 Usual Accessibility Problems

With regard to the accessibility problems of chats, users were asked to answer which problems they face when they interact with chats. Thus, they could select barriers from the list provided in the questionnaire. Furthermore, they were able to specify other accessibility barriers found. The list provided was:

1) A1: I cannot identify the colors and shapes
2) A2: There are icons which I do not understand.
3) A3: I cannot follow the flow and rhythm of the conversation.
4) A4: The icons are really small.
5) A5: I cannot write quickly.
6) A6: There are images without alternative text.

The answers to these questions are showed in the Figure 5. It can be observed that people with visual impairments experience more problems when they use chats. These problems are related to the flow and rhythm because they cannot write quickly as sometimes they need because of the use assistive technologies like speech

recognition software or braille keyboards (A5). Thus, they cannot follow the conversation (A3). The use of images, icons or buttons without alternative text is a handicap for them. In contrast, people who experience fewer problems in the use of chats are people with hearing impairments. They are really used to use chats and text messages to communicate with other people **¡Error! No se encuentra el origen de la referencia.**.

Moreover, the most usual problems that people experience are common problems of synchronous tools because they are related to the interaction (A5, A3). For instance, most people are not able to follow the flow and rhythm of the conversation (A3) and cannot write quickly when they are chatting (A5). The last one could be a consequence of the first one because while they are answering the last message the other person can write more messages and as a result he can feel lost and overwhelmed in the conversation because he has not the opportunity to answer previous messages.

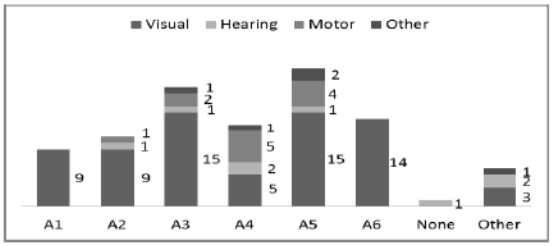

Figure 5. Chat Accessibility Problems per Disability

A part from the accessibility barriers provided by the questionnaire, users gave us information related to others accessibility barriers according to their experience. However, it is important to emphasize that these problems were experience by only one user such as: they cannot read the messages, the tabulation is not used properly and the user cannot navigate through the chat using the keyboard, they cannot access to all the functionalities through keyboard, they cannot hear the sounds and they feel insecure.

4.2.2.2 The "Stop Auto-refresh" Functionality

Users were explained a situation in which they were chatting with someone and they were receiving many messages at the same time. Thus, users could use the new functionality, ***Stop Auto-Refresh,*** and the new messages, which the other user wrote, will not be showed in the screen. After that, users were able to specify what should happen later and what the other user should do. The answers could be:

- AP1: The other user can write more messages and they will be showed together when I renew the conversation.
- AP2: The other user can write more messages and they will be showed one by one when I renew the conversation.
- AP3: The other user cannot write more messages until I decide to renew the conversation.
- AP4: The other user can write only one message more and will be showed when I renew the conversation
- AP5: The other user can write a new message but it cannot be sent until I decide to renew the conversation.

As the Figure 6 shows, most people prefer that the other user could write more messages while the conversation was stopped (AP1, AP2 and AP4). Besides, most of them wish that the new messages should be showed all together (AP1) instead of one by one (AP2). However, the least selected options were the options in which the other user cannot continue writing what he is thinking (AP3, AP5).

Moreover, other users provided new suggestions regarding to this new functionality. For instance, people suggested the transcription of the messages from voice-to-text and audio-to-text. Furthermore, other person specified that users should decide which the best feature is for them and they could select it to show the messages in that way. It is important to emphasize that to the author's opinion, allowing users to configure the chat preferences is really useful for users because they can adapt the chat to their necessities.

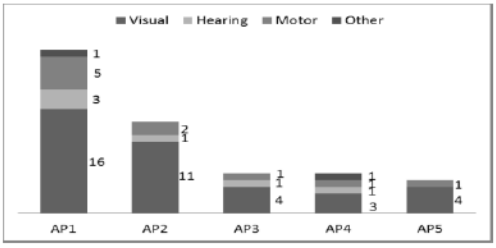

Figure 6. Selection after "Stop Auto-refresh" per Disability

Another question was related to the usefulness of the new feature. This question uses a 5 point Likert scale [15] (from 0 to 4; from "really no useful" to "really useful"). Figure 7 shows the main results obtained. We can observe that most users think that the new feature is really useful or really useful. If data is analyzed from the point of view of group disabilities, twelve people with visual impairments consider that the new feature is really useful for them and eleven consider it is useful. Besides, the second group of people that considers that this feature could be useful for them is motor impairments group because seven people answered it. In contrast, people with only hearing impairments consider that it is not useful for them. However, if this disability is combined with other disabilities like motor or visual impairments, this feature is useful for them too.

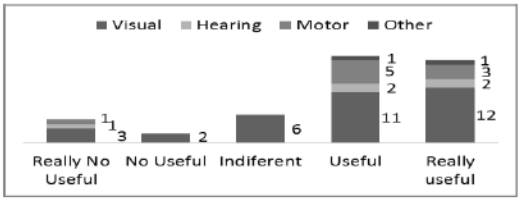

Figure 7. Usefulness of the New Feature per Disability

Furthermore, it is interesting to value how they would feel if they need to use this new functionality. This question uses a 5 point Likert scale again (from "Really not ashamed" to "Really ashamed"). The Figure 8 shows the feelings of each group. Most users consider that they would not be ashamed if they use this new feature and only ten people selected the option 3 or 4 to specify that they would be really ashamed or ashamed.

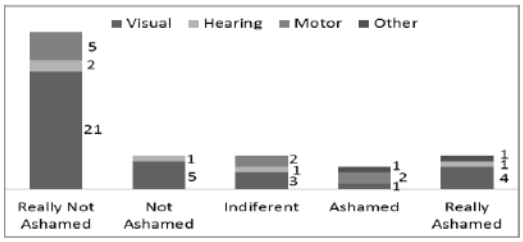

Figure 8. Feelings per Disability

4.2.2.3 User suggestions

Finally, users were able to specify their own suggestions to improve the chat which will be considered as new requirements. Next, these suggestions are categorized and explained:

- Documentation: chats should include manuals to use it.
- Size: letters, icons and buttons should be enough huge to be pressed and its size should be configurable by the user.
- Operating System: when the pad is moved, the system should read the information showed in the screen. Thus, it is important to provide more haptic gestures to control the chat interaction.
- Messages: the time between messages should be personalized (configurable by user) and the screen reader should be able to read new messages without any user interaction. Moreover, users should be able to specify the number of messages shown after stopping the conversation (configurable by user). Besides, they should be ordered by time in a descendent or ascendant way (the user should be able to select them).
- Alternative content: all images should have alternative content.
- Previous conversations: all conversations should be recorded for future reading.
- Rename users: chats should allow users to change the name of each user to avoid the use of large names and it should be allowed to use icons or other symbols.
- Keyboard: chats should allow users to select the keyboard which better adapts to his necessities and should be easy to use.
- Transcriptions: chat should allow the transcription of messages from text-to-speech and speech-to-text.
- Assistive technology support: all the information must be able to be accessed by all the assistive technologies.

5. ANALYSIS OF THE RESULTS

This survey helped us to elicit the requirements that a chat should have to be accessible from the point of view of the users and to obtain the users' opinion with regard to the new functionality, *Stop Auto-refresh*.

Regarding the accessibility barriers that users experience when they use chats, some of these barriers are not new, because they are typical problems that they usually face in other software, if it has not been developed with regard to accessibility requirements. For instance: the chat does not provide alternative content for the non-textual content, some functionality is not accessible through keyboard, the user cannot hear some sounds, and there are icons which cannot be understood by users. Besides, there are some accessibility barriers which are specific for synchronous environments like chats. These problems are related to the interaction in the conversation. For instance: they cannot follow the flow and rhythm of the conversation and they cannot write quickly. With regard to the accessibility problems per disability, the results underline next accessibility problems:

1) Visual impairments. Problems related to: shapes, sizes and colors and icons; follow the flow and rhythm of the conversation; and have difficulties writing quickly.
2) Motor impairments. Unsupported keyboards; use of small icons and have difficulties writing quickly.
3) Hearing impairments. Impossibility of hearing sounds.
4) Other impairments. Have difficulties writing quickly.

As the results show, almost all user categories had problems of interaction with the chat because they cannot write quickly.

Considering it, the new functionality, *Stop Auto-refresh*, could be really useful for many people because it improves the chat interaction. The results obtained in the surveys show that even people who use chats every day or two/three times per week consider that it could be useful for them.

From the point of view of what should happen after the user accesses to the *Stop Auto-Refresh* button, most users prefer that other user writes more messages when they have stopped the reception of messages. Moreover, they prefer that the messages should be showed all together instead of one by one when they renewed the conversation. In contrast, people prefer not to "annoy" the other user; thus, the least selected options were the options in which the other user cannot continue writing.

This new functionality could make users feel different from other people because when they access to this button, they inform other users that they cannot follow the conversation or they cannot write quickly. Thus, it was asked users how they would feel if they used this new functionality. The results obtained in the questionnaires and the interviews show that most users would not be ashamed, if they used this functionality.

6. CONCLUSIONS AND FUTURE RESEARCH

This study is part of a research in which a model-based design of an accessible chat will be created and the development process strategy to create an accessible chat will be specified. As it has been specified before, this research is currently in the analysis phase and this study has allowed us to obtain the necessities of users as well as to obtain the users' opinion with regard to the new functionality that we propose to include in the chat, the *Stop Auto-Refresh* functionality.

After this study, it could be concluded that the new feature, *Stop Auto-Refresh*, could be useful for most of people and that it could be really useful for people with visual, motor and learning or cognitive problems. Furthermore, they would not be ashamed, when they access to the button. Additionally, people prefer not disturbing other users and they prefer that they could write more messages when they have stopped the reception of messages. Besides, they prefer that these messages should be shown together instead of one by one.

Currently, a prototype of accessible chat is being implemented to complete the requirements' validation. This prototype includes some of the improved or new requirements which evolve the user interaction like the new feature *Stop Auto-Refresh* [6]. After that, the new features of the chat will be evaluated by users interacting with the prototype; thus, the requirements will be validated and checked. Finally, the model-based design will be created and the

development process strategy to create an accessible chat will be specified.

7. ACKNOWLEDGMENTS

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